Patent Claims

1. A drive train, comprising

1.1 an internal combustion engine (1);

1.2 an exhaust gas turbine (2), which is disposed in the flow of exhaust from the internal combustion engine (1);

1.3 a crankshaft (3), which is driven by the internal combustion engine (1);

1.4 the crankshaft (3) can be connected via a hydrodynamic coupling (4) to the exhaust gas turbine (2) in driven connection so that the crankshaft (3) is driven by the exhaust gas turbine (2);

1.5 the hydrodynamic coupling (4) has a primary impeller (4.1) and a secondary impeller (4.2), which together form a working chamber, which can be filled with a working medium for transfer of torque;

1.6 the primary impeller (4.1) is in driven connection with the exhaust gas turbine (2);

1.7 the secondary impeller (4.2) is in driven connection with the crankshaft (3);

1.8 the primary impeller (4.1) can be mechanically braked and locked against a rotational motion, so that the hydrodynamic coupling (4) assumes the function of a hydrodynamic retarder;

is hereby characterized in that

1.9 a controlling is provided, which empties, in a targeted manner and to a prespecified level of filling, the working chamber of the hydrodynamic coupling (4) before and/or during the braking of the primary impeller (4.1) upon switchover to the retarder operation, in which the hydrodynamic coupling (4) assumes the function of a hydrodynamic retarder.

2. The drive train according to claim 1, further characterized in that a multiplate coupling (5), which is configured for the mechanical braking and locking of the primary impeller (4.1), is assigned to the primary impeller (4.1).

3. The drive train according to one of claims 1 or 2, further characterized in that the hydrodynamic coupling (4) is disposed in the cooling circuit (6) of a vehicle and the working medium is the vehicle cooling medium.

4. The drive train according to claim 3, further characterized in that a 3/2-directional control valve (7) is disposed in the cooling circuit (6) in the flow direction in front of the hydrodynamic coupling (4), which valve distributes the flow of working medium that is flowing in, in the direction of the hydrodynamic coupling (4) and in the direction of the internal combustion engine (1) when the primary impeller (4.1) is not braked, and directly prior to braking and/or during braking of the primary impeller (4.1), interrupts the flow of working medium in the direction of the hydrodynamic coupling (4).

5. The drive train according to claim 3, further characterized in that a throttling site, which can be switched on or which can be regulated, is provided in the direction of flow in front of the hydrodynamic coupling (4), which site throttles the flow of working medium into the working chamber of the hydrodynamic coupling (4) directly prior to the braking and/or during the braking of the primary impeller (4.1).

6. The drive train according to one of claims 3 to 5, further characterized in that a discharge oening, which can be switched on or which can be regulated, is provided in the direction of flow behind the hydrodynamic coupling (4), in particular, a discharge control valve (19), which increases the flow of working medium from the working chamber of the hydrodynamic coupling (4) when the working chamber is emptied.

7. A method for controlling a drive train according to one of claims 1 to 6, with the following steps:

7. 1 in the operation for utilizing the exhaust gas energy with driven exhaust gas turbine (2), the working chamber of the hydrodynamic coupling (4) is kept substantially or completely filled with working medium and none of the blade wheels of the hydrodynamic coupling (4), primary impeller (4.1) and secondary impeller (4.2) is mechanically braked;

7.2 in the retarder operation, when primary impeller (4.1) is mechanically locked, the working chamber of the hydrodynamic coupling (4) is kept filled at a prespecified level of filling;

7.3 during switchover from the operation for utilizing the exhaust gas energy to the retarder operation, prior to the mechanical braking and/or during the mechanical braking of the primary impeller (4.1) of the hydrodynamic coupling (4), the working

chamber of the hydrodynamic coupling (4) is emptied to a prespecified level of filling or is emptied completely.

8. The method according to claim 7, further characterized in that the prespecified level of filling of the working chamber of the hydrodynamic coupling (4) during the retarder operation is lower than the level of filling during the operation for utilizing the exhaust gas energy.

9. The method according to claim 8, further characterized in that in step 7.3, the working chamber of the hydrodynamic coupling (4) is directly emptied to the level of filling specified in advance for the retarder braking operation.

10. The method according to claim 8, further characterized in that in step 7.3, the working chamber of the hydrodynamic coupling (4) is first emptied to a level of filling, which is lower than that of the level of filling prespecified for the retarder braking operation

11. The method according to claim 10, further characterized in that in step 7.3, the working chamber of the hydrodynamic coupling (4) is substantially or completely emptied.

12. The method according to one of claims 7 to 11, further characterized in that the working chamber of the hydrodynamic coupling (4) is emptied by throttling the flow of working medium introduced into the working chamber.

13. The method according to one of claims 7 to 12, further characterized in that the working chamber of the hydrodynamic coupling (4) is emptied by increasing the flow of working medium discharged from the working chamber.

14. The method according to one of claims 7 to 11 or 13, further characterized in that the emptying is conducted by interrupting the flow of working medium introduced into the working chamber.